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POPULATION CHANGE AND THE FUTURE LABOUR FORCE: A DISCUSSION PAPER

by

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POPULATION CHANGE AND THE FUTURE LABOUR FORCE: A DISCUSSION PAPER

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1. Introduction

The population of Canada has been growing for as long as records have been kept, as has the labour force. However, the path of growth has been very uneven, ranging from very rapid growth in some decades to much slower growth in others. As is well known, the rate of population growth has slowed considerably in recent years, largely because of the dramatic decline in the birth rate, and the rate of labour force growth is now slowing too. Most observers expect birth rates to remain low by historical standards, in which case low rates of population and labour force growth will persist for many decades to come. If so, the demographic future will be unlike the past. This paper provides some projections of likely future changes, places them in historical context, and discusses some of the implications associated with such changes.

We proceed as follows. In the next section we review briefly the record of population and labour force growth in Canada and its major regions over the past half century, noting the major changes that have taken place in age-sex composition as well as in regional composition. Projections of the future population and labour force are provided and discussed in section 3, based on a variety of underlying assumptions. Some implications of the changes that are in prospect are discussed in sections 4 and 5, followed by suggestions for a research agenda in section 6.

2. Historical Aspects

The top panel of Table 1 provides summary information relating to the size and age distribution of the population of Canada for each census year from 1951 to 1981[1]. Among the main features, we note the following:

- the overall population grew from 14.0 million in 1951 to 24.3 million in 1981;
- the growth during the 1950s was especially rapid (more than 30 per cent between 1951 and 1961), these being the peak years of the "baby boom";
- the growth rate has declined subsequently (it was less than 13 per cent between 1971 and 1981);

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- the age distribution of the population has changed markedly: the proportion under 20 had declined to 32 per cent by 1981, from a peak of more than 42 per cent in 1966; most of the corresponding gain occurred in the age group 20-64, which increased from 50 to 58 per cent over the same period, but the proportion over 65 also increased by 2 percentage points, to 9.7 percent of the overall population.

Three ratios based on various population measures are contained in the second panel. The first, which might be referred to as a "young dependency ratio", is the ratio of the young (those under 20) to those in the main "providing" years (20-64). An "old dependency ratio", the ratio of the population 65 and over to the population aged 20-64, is provided in the second row of the panel. Finally, the third row shows the ratio of females to males in the 65-and-over age group. We note the following points:

- the young dependency ratio fell sharply with the "baby bust" of the last quarter century, from .84 in 1966 it had fallen to .55 in 1981 – the lowest level by far in the 30-year period for which figures are shown in the table;

- the old dependency ratio increased somewhat over the 30-year period, reaching .17 by 1981;

- the overall dependency ratio (obtained by adding the young and old ratios) was only .72 in 1981, its lowest level in the entire period, and down sharply from .99 only 15 years earlier;

- the ratio of older women to older men, which had been below 1.0 until 1956, has increased remarkably since that time, such that by 1981 there were 134 older women for every 100 older men; this change is the direct consequence of the great reduction in the numbers of deaths in childbirth, combined with the general (and largely unexplained) reduction in female mortality rates at older ages, relative to the corresponding male rates.

Labour force information is contained in the third panel. Since the measured labour force is drawn from the population 15 and over, its growth reflects population growth, but with a lag of 15 to 20 years. Of course, labour force growth also reflects changes in participation rates. It is well known that female participation rates, in particular, have increased greatly, and the rates of labour force growth have therefore exceeded by a considerable margin the corresponding rates of population growth two decades earlier. In fact, the labour force grew by almost one-quarter during the 1950s, by more than 30 per cent during the 1960s, and by almost 38 per cent during the 1970s. This growth is reflected in changes in the age distribution of the working population, the relative increase in the youngest group between 1961 and 1976 being especially noteworthy.

Dependency measures based on ratios of population to labour force, analogous to the measures based on population ratios, have the advantage of identifying as the "providers" only those in the labour force, rather than all those in the main age groups from which the labour force is drawn. Whichever measure is used, however, the message

is similar: the young dependency ratio (defined here as the ratio of the population under 20 to the total labour force) has decreased sharply since 1961, while the old dependency ratio (those 65 and over to the labour force total) has not. By 1981 the sum of the young plus old ratios was at its lowest level in the entire 30-year period – .86, as compared to a peak of 1.37 only 20 years earlier. An alternative dependency measure is based on the ratio of the overall population to the labour force. In 1981 this ratio was 2.03, by far the lowest level recorded over the entire period.

We note also the substantial increase in the ratio of women to men in the labour force – from 30 women per 100 men in 1951, to 39 by 1961, and to 69 by 1981.

Finally, we note the regional distribution of the population and labour force. Since 1951 both the population and the labour force resident in the Atlantic Region have declined fairly steadily as a proportion of the Canada total, while those of B.C. have increased. Quebec, which held fairly constant in relative terms until the latter part of the 1960s, has seen both its population and its labour force grow more slowly than the Canadian average since that time. In the case of the Prairies, the long-term reduction in both population and labour force (in relative terms) was reversed, at least temporarily, starting in the 1970s. Finally, the share of both population and labour force in Ontario generally increased over the 30-year period, although there were some reductions at the very end.

3. Projections of the Future Population and Labour Force

The course of population change in Canada has not been smooth, as is clear from the preceding comments. It has been the result of largely unanticipated fluctuations in rates of fertility and net immigration, combined with generally downward movements in mortality rates. The future course of the population will no doubt also be subject to shocks of various sorts, and therefore forecasts cannot be made with great confidence. Nonetheless, we can explore the implications of alternative plausible assumptions about the future time paths of key demographic rates, to see what differences are implied for the overall size and age distribution of the population and the labour force.

A population projection for Canada for the period from 1986 to 2036 under what we term "standard" assumptions is provided in Table 2. These assumptions are as follows:

> *Standard Assumptions for Population Projection*: The total fertility rate remains at its recent level of 1.7 births per woman; age-sex-specific mortality rates continue to fall for a further 50 years after 1981 in accordance with trends observed between 1961 and 1981, but the pace of decline gradually slows, and there is no further change after 2031; net immigration into Canada is 50,000 per year, consisting of 100,000 immigrants and 50,000 emigrants – levels roughly consistent with the experience of the last few years.[2]

The major implications of these assumptions may be summarized as follows:

- the overall size of the population continues to increase until 2026, when it is 19 per cent larger than in 1986;

- however, the pace of growth is very much slower than in recent decades, and growth turns to decline by the end of the projection period;

- with the fall in the rate of growth there is a sharp increase in the median age of the population, from 31.5 in 1986 to 37.7 by the year 2001, and then to 45.2 by 2036;

- largely in consequence of the assumed total fertility rate of 1.7 (which is well below the long-run natural replacement rate of 2.1), the number of young persons falls steadily; those 19 and under account for only 20 per cent of the population in 2036, compared to 29 per cent in 1986;

- the population 20-64 years of age grows by 19 per cent over the next two and one-half decades; it accounts for 60.5 per cent of the total in 1986, a record high proportion historically, but this proportion increases further, until 2011, before falling back to levels experienced in the 1970s;

- the elderly population increases very rapidly: 15 years hence, in the year 2001, there will be 41 per cent more people 65 and over than there are today, and by 2036 there will be a further increase of 96 per cent;

- in relative terms, those 65 and over will account for more than 13 per cent of the population by the year 2001, and 25 per cent by 2036, compared to less than 11 per cent in 1986;

- while persons 65 and over constitute the most rapidly growing segment of the population in terms of broad age categories, within this group we can see that the numbers over the age of 75 or 80 increase especially rapidly;

- finally, among the elderly the ratio of women to men continues generally to increase, with the increases being greater the older the age; this suggests particularly large increases over the next few decades in the number of elderly widows.

The labour force can be projected by combining assumptions about future labour force participation rates with the population projection. The assumptions regarding participation rates are, roughly speaking, that the recent trends observed for particular age-sex groups will continue for some years into the future. More specifically, we assume further declines in the participation rates for men aged 55 and over, and especially for those 65 and over, and continued increases for women at most ages[3].

The resultant labour force projections are provided in Table 3. Under the assumptions made, the overall labour force continues to grow until 2011, but the rate of growth is cut by about half in each successive decade following the 1970s, until eventually slow growth turns to decline within the next three decades.

As already noted, the baby boom generation reached labour force age between the late 1960s and the early 1980s. During this period the overall labour force, and especially its young component, grew rapidly, and the average age decreased. As the baby boom generation ages, and passes through its working years, it will be followed by cohorts of considerably smaller size. For the next decade we can expect a continuing decrease in the age group 15-24 and a concomitant increase in the group 25-44. Thereafter we can anticipate a substantial increase in the labour force 45-64. From the projection we indeed see that, by 1991, the size of the youngest group decreases from its 1986 level by 330,000, in addition to a decline of 276,000 between 1981 and 1986. Also by 1991, we can anticipate that the labour force aged 25-44 will experience a large increase (over 850,000), and that within 15 years there will be particularly large growth in the labour force 45-64 – about 51 per cent from 1986 to 2001 – followed by a further 21 per cent increase in the subsequent decade.

Put differently, in about 15 years those aged 45-64 will account for a much larger fraction of the labour force than they do at present, and for a still larger proportion thereafter, while the fraction accounted for by those 25-44, and especially those 15-24, will decrease. One summary measure of this change is provided by the median age of the labour force which, at 34.7 in 1986, was already up from recent years. By the year 2001 the median will be 38.8 and still rising, according to this projection.

The population projection which we have called "standard" is, of course, just one possible statement of the demographic future. The assumptions which underlie it could be quite wrong. To gain some idea of how much difference alternative assumptions would make we report, in Table 4, projections under alternative assumptions about fertility, mortality, and immigration rates. We also repeat the standard projection and the 1986 population, for ease of reference.

The assumptions underlying the various alternative projections can be summarized as follows:

High Fertility: The total fertility rate is assumed to rise in equal annual increments from 1.7 births per woman to 3.0 births per woman by 1996, and to remain at that level thereafter; other assumptions are the same as in the standard projection.

Low Fertility: The total fertility rate is assumed to fall in equal annual decrements from 1.7 births per woman to 1.4 births per woman by 1996, and to remain at that level thereafter; other assumptions are the same as in the standard projection.

High Mortality: Age-sex-specific mortality rates continue to decline, but only until 2011 instead of 2031; other assumptions are the same as in the standard projection.

Low Mortality: Age-sex-specific mortality rates continue to decline, but the period of decline is extended to 2081 instead of 2031; other assumptions are the same as in the standard projection.

High Immigration: Annual gross immigration is 150,000 instead of 100,000; other assumptions are the same as in the standard projection.

Low Immigration: Annual gross immigration is 50,000 instead of 100,000; other assumptions are the same as in the standard projection.

For each projection the overall population size is recorded in Table 4, along with an index of size relative to 1986. Also recorded is the age distribution, showing four age groups: 0-19, 20-64, 65-74, and 75 and over.

It is clear from the table that the overall size as well as the age distribution depend very much on the underlying assumptions, and that the differences are greater the further into the future one looks. With high fertility, for example, a return to rapid population growth occurs, and the population size by the year 2001 exceeds that projected under standard assumptions for the year 2036. The growth in the population between 1986 and 2036 is more than five times as much with "high" than with "standard" fertility. The impact on the age distribution is most pronounced: with high fertility there is an early reversal of the decline and then a sharp increase in the proportion under 20, instead of a continued reduction. There is also slower growth in the proportions 65-74 and 75 and over, although these proportions generally do continue to rise.

The differences from the standard projection are less marked under the other assumptions, but still substantial. With low fertility, for example, population growth ceases a decade earlier than in the standard case, and the proportions in the older years increase somewhat more sharply than under the standard assumptions. With higher mortality rates the population and its proportion in old age grow somewhat less, while with lower rates both the overall size and the proportion in old age are somewhat greater; however, the differences are not large, compared to the standard projection. Finally, the level of immigration also matters, but the differences from the standard projection in terms of the population age distribution are relatively slight.

In summary, aside from a possible (but perhaps unlikely) return to high fertility levels, we can see that under a rather wide range of assumptions the population over the next several decades will have a considerably larger proportion of older people. Under the standard assumptions, more than one person in eight will be 65 and over by the turn of the century, and by the year 2036 the ratio will be close to one in four. These ratios differ somewhat, but not markedly, depending on the particular projection (again, aside from a possible return to high fertility rates). The increases in the elderly proportion are offset in part by decreases in the proportion of young people. The net result of these offsetting changes at the two ends of the age distribution is that the proportion in the ages 20 to 64 falls somewhat, but not drastically. In fact, we can see that only with the assumption of an early return to high fertility rates does the proportion in the 20-64 group fall as low as it was in the 1960s, and even in that case the low levels of the 1960s do not recur until after the year 2021. This observation alone should be reassuring for those who are concerned about the possible inability of the economy to support its dependent population – young and old – in the decades ahead.

Summary information relating to the labour force associated with each of the above population projections is provided in Table 5, in each case based on the same set of future labour force participation rate assumptions described earlier. Aside from the case of an assumed return to high fertility levels, the aggregate labour force continues to grow until about 2011, after which it declines. The details differ somewhat from one projection to another, but the picture is broadly similar in all cases: the large fraction of the labour force represented by the youngest age group will soon be a thing of the past as the large baby boom cohorts complete their passage into the 25-44 age group (roughly by the end of the 1980s) and then into the 45-64 group (by 2011). More specifically, it is projected that by 1991 the proportion of the labour force accounted for by those 25-44 will first increase by more than 8 percentage points, as compared to 1981, and then return to approximately the 1981 proportion by 2011. By that time the proportion 45-54 will have increased by more than 10 percentage points, again as compared to 1981, and will remain at that higher level. With an assumed return to high fertility, however, the decline in the proportion in the youngest age group would be reversed by about 2011, the decline in the proportion 25-44 would be smaller, and the rise in the 45-64 group would peak by 2011, before declining to approximately its 1981 level.

Table 6 provides a variety of dependency ratios associated with each of the projections. The first two are based on population ratios (the populations aged 0-19 and 65 and over relative to the population 20-64) and the next three on labour force ratios (for the same two population groups, plus the ratio of total population to total labour force). These are the same ratios as reported for the period 1951-1981, in Table 1. We observed earlier that both of the "young dependency ratios" were at record low levels in 1981, and both of the "old dependency ratios" at or near record high levels. It is clear from Table 6 that for the standard projection, as well as for all other projections except the one relating to high fertility, the two young dependency ratios continue to decline for at least another quarter century, while the old dependency ratios continue to rise. The old dependency ratios continue to rise even in the high fertility projection, and the young dependency ratios, although they rise, never attain the levels observed between the mid-1950s and the early 1970s. In all of the projections, the total dependency ratio (shown in the last column) continues to fall for a time, and then rises somewhat, but remains far below the levels observed throughout most of the postwar period. Again, these observations should be reassuring for those who are concerned that the demographic changes which are in prospect will prove unduly burdensome: the demographic ratios, at least, suggest otherwise for the entire range of projections provided here. (It should be noted that the overall social costs associated with old dependents may exceed those associated with young dependents. Even so, the increase in total costs is not likely to be onerous provided the *allocation* of resources responds to changes in the population proportions. We comment further on this matter in our companion paper, "Population Change and the Canadian Economy: A Survey of the Issues.")

Some possibilities for further work follow from the preceding discussion. One would wish to consider carefully the assumptions underlying the alternative population projections, with a view to defining others whose implications might be investigated – either because they may be of interest in themselves or because they may appear to be more "realistic". The importance of fertility rates, in particular, in determining the size and age distribution of the future population and labour force, are made evident by

the projections discussed. This observation highlights the unfortunate absence of any convincing theoretical basis on which to project fertility rates.

In addition to further work at the national level, one might wish to consider various future patterns of internal migration, and determine the effects that they would have on the regional or provincial distribution of population.

Working from any given set of population projections, the projection of the labour force depends solely on the assumptions about (or the modelling of) the age-sex-specific participation rates. Clearly further attention should be given to the specification of these rates. Attempts to model participation behaviour in a manner appropriate for use in medium- to long-term projections might be desirable. Most research attention in recent years has emphasized the importance of life-cycle considerations in affecting labour force behaviour. At a general theoretical level, there is scope for the further development of models which allow for the simultaneous determination of income, "leisure", and fertility at the micro or household level, and the assessment at the macro-level of the implications of changes in tastes or external circumstances. (See, for example, Denton and Spencer forthcoming.) The extensions we have in mind could take into account the potential for continued investment in human capital, the existence of universal pension plans (the CPP/QPP), the inevitable uncertainty associated with one's future unemployment, health and life expectancy, and other matters of interest. In all cases the central purpose of the analysis would be to provide a vehicle that would permit the assessment at the macro-level of optimizing behaviour which takes place at the micro-level. Simulation analysis of theoretical but numerically specified computer-based models has proved a fruitful way to approach problems of this sort in the past. Once such ideas have been developed and explored theoretically, attempts could be made to estimate the model parameters and then to incorporate the results into a comprehensive econometric-demographic model for Canada.

Aside from the development and extension of current theory relating to labour force behaviour in the context of aggregate population change, two suggestions relating specifically to demographic changes come to mind. These might be taken into account in the projection of labour force participation rates with only a minimum of further theoretical work. First, female participation rates could be linked to projected changes in fertility rates, as well as to the general state of the labour market. Second, in the projection of rates for older males one could attempt to take into account the lifetime income prospects of individual cohorts with a view to gaining a better understanding of the future course of typical retirement ages.

4. Some Implications of the Prospective Changes

The labour force projections suggest that, aside from a possible return to high fertility, we can anticipate considerable aging of the labour force over the next few decades. Furthermore, the projections indicate that if recent trends persist, the labour force size will reach a peak within the next 25 years, and then decline—the first such decline in Canadian history.

We now turn to consider possible implications for the labour force and for the macro-economy associated with the trend towards slower rates of labour force growth. What impact will slower growth have on the circumstances of individual cohorts and members of those cohorts over the next few decades? What effect will slower labour force growth have on the economy's productive capacity?

Let us start with the idea of the economy's productive capacity, and consider how the labour force changes that are in prospect might be expected to affect it. At a high level of aggregation, the productive capacity of the economy at any time reflects three things – the available stocks of capital and of labour and the state of technology. Greater output potential would be associated with technological advance, with a larger capital stock, or with a larger labour force. But what is in prospect is a labour force which will grow increasingly more slowly and then, within a few decades, the slow growth will turn to decline. What can be said about productive capacity in such circumstances?

The answer depends, in significant measure, on one's views regarding how technological advances are introduced into the productive process. Clearly there is no simple answer. However, economists have come to distinguish between embodied and disembodied technological change, and this distinction is helpful for present purposes. The central characteristic of *embodied technological change* is that it must be incorporated somehow into a factor of production before its effect can be felt. One possibility is that the latest technology could be incorporated into newly produced "vintages" (or cohorts) of machinery and equipment, in the sense that its physical characteristics would reflect and take advantage of the most recent developments. The other possibility is that advances would be reflected in those cohorts (or "vintages") of workers currently leaving the educational system, and newly entering the labour force. In either case, the technology, once embodied, is usually viewed as "fixed" for the life of the equipment or the worker, and the rate at which new technology could have an impact on productive capacity would be limited by the rate at which new cohorts were being added to the stock of either capital or labour. One implication of this view of technological advance is the possibility that workers would become increasingly technologically obsolete as they aged. And, of course, the problem would be more severe the more rapid the pace of change. Put differently, it would mean that the benefits of increased on-the-job experience would be considerably less advantageous than otherwise, and would operate as less of an offset to the obsolescence of skills learned in youth. Continued training throughout the working life would mitigate the "vintage" effect, and serve to maintain the investment in the human capital of older workers.

Disembodied technological change, on the other hand, is not limited by the rates at which additions are being made to current stocks. Instead, the nature of disembodied technological change is that it affects the productive characteristics of all existing units in equal proportion, whether they are of the most recent vintage or not. In general, if technological advances were properly characterised as disembodied, they would have a more substantial impact on the economy's productive capacity, at least in the short run.

While the distinction may be clear conceptually, it is difficult to distinguish empirically between embodied and disembodied technological change. Whatever the form of technological change, however, there is reason to think that the slower rates of labour

force growth that are in prospect will have somewhat less of an impact on the productive potential of the economy than one might have supposed, at least in the medium term. The reason has to do with the age pattern of the productive characteristics of typical labour force cohorts between the time they enter the labour force and the time they retire from it.

Individuals, on average, enter the labour force in their late teens or early twenties. With experience, their productivity levels and incomes rise, at first perhaps rather quickly, and then more gradually as they age. Age-related productivity gains may act as an offset to the reduction in numbers associated with slower labour force growth. Of course, the offset will not last forever, but for a period it could be significant. Some illustrative but now dated calculations relating to this matter are provided in Denton and Spencer (1979). We calculated an historical series in which the labour force of each age-sex group was weighted by a measure of its relative productivity, and also weighted the projected labour force in a similar manner. We found that in the early 1970s, when the baby boom generation reached labour force age in large numbers, the productivity weighted labour force measure (WLF) grew by 15.9 per cent, as compared with 18.9 per cent for the standard labour force measure (LF). However, for the last half of the 1970s through the first half of the 1990s, the projected WLF growth rates were somewhat higher than the LF measures. Thus it appears that the productivity potential of those in the baby boom cohorts may act as an important offset to the smaller size of the more youthful cohorts that follow. (The realization of the potential would, of course, depend on the prevailing general level of unemployment.) Furthermore,

> "The WLF series take account only of age and sex differences, and thus represent only a partial adjustment for productivity changes. To the extent that younger cohorts are better trained or educated, there will be a further rise in overall average productivity levels, as these cohorts age and take the place of older ones. To the extent that their unemployment rates decline as they age – and historical experience suggests strongly that one should expect this – their labour services will be more fully utilized. For both of these reasons, the effective drop in the rate of growth of the labour supply may be less than indicated by the WLF series, and substantially less than is suggested by the projections of the labour force alone." (Denton and Spencer 1979, 247)

Another observation worth making is that individuals typically work well below their productive capacities. Thus, even though one's capacity (especially for manual tasks) may decline slowly with age, individual output need not. Greater attention to the design of jobs, so that they take into account the age-varying characteristics of workers, and the continued use of training programs for workers of all ages are possibilities.

The above comments suggest a number of possible directions for research. We have estimated (in an earlier study) age-productivity profiles for men and women, based largely on 1951 and 1961 census earnings data. These profiles are now considerably out of date, and new profiles could be developed, based on more recent data and perhaps improved methods. Account should be taken of recent literature which suggests that wage profiles might not be a satisfactory measure of relative productivity, since they reflect, among other things, a variety of institutional arrangements which tie wage gains to

seniority, and hence may underestimate the productivity characteristics of relatively recent labour force entrants and overestimate those of older workers. Revised and updated age-productivity profiles could be used in conjunction with a range of projections (such as those in section 3) to explore the implications that alternative labour force projections have for Canada's future productive potential.

An issue closely related to the age-earnings profiles is that of income distribution. If members of any given birth cohort can be regarded as both homogeneous and endowed with productive characteristics which distinguish them from members of other cohorts (for example, the date at which formal education was completed), each cohort might be appropriately viewed as a distinct factor of production. In that case the lifetime incomes, as well as the annual incomes, of each cohort will depend in part on its size relative to other cohorts. Various studies have found evidence of this type of effect but the impact of cohort size on cohort income would benefit from further investigation.

There is reason to think that age-productivity profiles might vary substantially from one industry to another depending, in part, on skill requirements, the technology in use, and so on. Age-productivity profiles could be estimated separately for different industries and occupations, based on earnings data (and having regard for the limitations of such data for inferring productivity). These profiles could then be used in conjuction with industry-specific or occupation-specific projections of the labour force, by age and sex.

The prospective changes in the age distribution of the labour force may also give rise to concerns regarding the promotion and mobility prospects of individuals. Various authors have paid attention to such considerations. The basic idea, as suggested by Keyfitz (1973), is that one's promotion prospects are influenced by age distribution: if organizations (and the labour force as a whole) tend to be structured in such a way that advancement is strongly associated with age (or experience), and the ratio of workers of a given rank to others above and below them is fixed, then the typical age at which a given rank is attained will vary inversely with relative cohort size. Hence one might anticipate that those now in their late 20s or early 30s, who were born during the baby boom period, would experience relatively slow rates of advancement, and that their attainment of senior rank would come rather late in their working lives.

Elsewhere we have reported a preliminary investigation of this phenomenon in the context of both hypothetical steady state populations and labour forces and the historical and projected population and labour force of Canada. Among the conclusions reached are the following:

> "... age of reaching middle rank is estimated to have increased by 1 year between 1956 and 1966, and then declined by 1.6 years by 1976, based on the labour force measure. The age of reaching that same rank is expected to increase by 2.2 years by 1991 and by a further 2.9 years by 2001, under our standard projections assumptions [which, it should be noted, differ from the standard assumptions of the present paper]. The age of reaching the highest rank is estimated to have declined by 1.8 years between 1966 and 1976. It should continue to decline until 1991, and then rise by almost 4 1/2 years by

> 2021, suggesting a substantial delay in the promotion of typical individuals reaching their fifties during this period." (Denton and Spencer 1982, 13)

There are other age-related aspects of mobility too. Both geographic mobility and job mobility tend to decline with the age of the worker, and one might anticipate somewhat more difficulty associated with economic adjustments in the years ahead, in consequence of labour force aging. However, it is easy to underrate the ability of the economy and of individuals to adjust when the circumstances warrant and incentives are present.

The whole issue of the effects of population aging on labour force mobility – hierarchical, geographic, and between employers, industries, and occupations – seems to us an important one in drawing up a research agenda.

5. Implications of Labour Force Change for Industries and Occupations

We turn now to consider some aspects of prospective labour force change for particular industries and occupations. While the age distribution of the labour force summed over all industries or all occupations is closely approximated by the age distribution of the total labour force (which includes persons with no industrial or occupational attachment), not all industries and occupations have the average distribution. Indeed, some are very different.

Figure 1 shows a pyramid representing the age-sex distribution of the labour force in all occupations (or, equivalently, all industries) taken together. The figure, which is based on 1981 census data, shows age in five-year intervals running from 15-19 at the base of the pyramid through to ages 60-64, and then the open-ended class, ages 65 and over, at the top. Males are plotted to the left of the vertical axis, females to the right. The length of each horizontal bar indicates the percentage of the total represented by an age-sex group; thus the lengths of the bars sum to 100.0. We observe a strikingly pyramidal shape, although the left side is relatively large (reflecting the ratio of males to females in the labour force) and the base is narrow (reflecting both the impact of the early post-baby boom group on the labour force and the fact that many in the youngest age group were still in school).

Let us consider now the pyramids for two selected occupational groups – elementary and kindergarten teachers and doctors – to see how they compare to the overall distribution.

The pyramid for elementary and kindergarten teachers is shown in Figure 2. We observe immediately the predominance of females who report this occupation, and the paucity of males: the ratio is about 4 to 1. Figure 3 provides a variety of comparisons of the elementary teaching occupation with all occupations combined. (We refer to these plots as "pyramids" also, for want of a better term.) The first two pyramids in the upper row compare the age-sex distribution for the given occupation with the corresponding distribution for all occupations combined; the last pyramid in the first row compares the age distribution (disregarding sex) with the corresponding all-occupation age distribution.

(The points plotted represent percentages in the given occupation less the corresponding all-occupation percentages.) They show that males of all ages tend to be underrepresented in this occupation and females, especially between the ages of 25 and about 50, to be greatly overrepresented. Furthermore, for both sexes together, there is a very considerable concentration of teachers aged 30-34 and 35-39 and, to a lesser extent, aged 25-29 and 40-44, as compared to the overall distribution, and an underrepresentation at ages 15-19 and 20-24. The pyramids in the second row compare, separately for males and females, the age distribution within the occupation with that across all occupations. In the case of males there are relatively few elementary teachers 15-19, 20-24, and 45 and over, but relatively many in the age groups 25-29 through 40-44. The age pattern of females resembles that of males, but the relative abundance in the age groups 30-34 and 35-39 is less extreme.

The striking differences between the age patterns in this occupation and that of the overall labour force result in large measure from the rapid expansion of the elementary school system to accommodate the entry of the baby boom generation. That expansion, which started in the 1950s, took place very largely through the hiring of young teachers, mostly female, who have simply aged along with the boom generation and, in many cases, remained elementary teachers. In consequence, there has been very little hiring in recent years. Casual reflection suggests possible difficulties for the future: the median age of elementary teachers was over 35 in 1981. With only low levels of new hiring in prospect, the median age will increase rapidly, and the entire age distribution of the occupation will become sharply skewed towards the older end. Aside from deaths and early retirements, it appears that the largest group of elementary teachers in 2011 will be in the age interval 60-64!

A similar set of pyramids is presented for the occupation physicians and surgeons in Figures 4 and 5. By comparison with elementary school teachers, we are struck, on inspection of Figure 4, by the relatively uniform age distribution, the high ratio of males to females (about 5 to 1), and the much larger female proportion at younger ages than at older ages. From Figure 5 we see the relative overrepresentation of males at ages 25 and above, and their underrepresentation at younger ages, compared to the age distribution of males in all industries – an inevitable consequence of the long training period required for this occupation. There is no obvious distributional problem associated with the normal aging of members of this occupation.

We consider now similar pyramids for two industries, namely agriculture and manufacturing.

In the case of agriculture, Figure 6 shows a strikingly rectangular shape: especially in the case of males, approximately the same proportion is observed in each age group. Thus it is evident that the age of a typical male in farming is considerably above that for males in all industries combined. Figure 7 provides greater detail. We see that males in this industry are overrepresented in the several oldest age groups and also in the youngest, and furthermore, that their median age is 41.3, compared to the overall median of less than 35.

Manufacturing industries are represented in Figure 8. Casual inspection suggests that this distribution closely resembles the all-industry distribution. That impression is confirmed by Figure 9, where we find no major differences between manufacturing as a whole and all industries. We observe, however, that males are somewhat more likely to be in manufacturing, and females less likely.

It is well known that with the aging of the baby boom generation the average age of members of the labour force will increase, and one might anticipate various difficulties in consequence. What is suggested by the figures we have just discussed, however, is that the age distributions of particular occupations and industries vary substantially from the overall distribution. Some such industries may face difficulties of adjustment associated specifically with the age distribution of their labour forces. It would, therefore, be of interest to identify those industries with age distributions substantially different from the average. The systematic identification of such industries could be done based on the approach illustrated above. The approach could be extended to consider distributional differences among regions and provinces, as well as industries and occupations.

6. Some Suggestions for a Research Agenda

We have identified in previous sections a number of issues that we believe could be the basis for further research. Here we bring together the research topics that have been suggested.

One suggestion concerns the population and labour force projections, which are at the heart of any analysis of the demographic future, and the assessment of their implications. Any number of alternative projections can be made simply by varying the assumptions which underlie them. The central issue, then, has to do with the assumptions themselves – that is, with the projection of the rates of fertility, mortality, and migration in the case of the population projections, and with the projection of labour force participation rates in the case of the labour force projections. We suggest that particular thought be given to the basic assumptions – and especially to those relating to fertility and labour force participation rates. Much attention has been paid to the theoretical and empirical modelling of these rates, but no one approach has received wide acceptance. Nor does any approach which has been suggested thus far provide a satisfactory basis for making *long-term* projections. It would fall within the terms of the Review to commission studies designed to survey those approaches that have been developed, to assess their merits, and to suggest alternatives.

Another suggestion concerns the analysis of the implications that a continued slower rate of labour force growth will have for the macro-economy, and specifically for its future productive capacity. We have suggested that changes in the labour force age-sex distribution are important in this regard, since there are differences in the productivity characteristics of average individuals at different ages. Further work could focus on the development of age-productivity profiles at different levels of education for eventual incorporation into a larger model of economic activity or, more simply, for use in conjunction with alternative labour force projections. Such profiles should take into

account the view that the age pattern of wage receipts may not be the best measure of the age pattern of productivity.

Closely related to the prospective changes in productive capacity associated with population and labour force changes are possible effects on the distribution of income. The impact that the relative size of a cohort has on its return in the labour market is an issue of continuing importance.

Individual promotion prospects may be systematically related to changes in the population age distribution. Further work might explore the implications that prospective population and labour force change of the kind that we anticipate in Canada could be expected to have on the promotion prospects of typical members of various cohorts. Such analysis could be undertaken not just at the all-Canada level, but also at the level of individual regions, industries, and occupations. The analysis should pay particular attention to the labour force behaviour of women in this regard; the patterns of female labour force entry and exit are more difficult to incorporate into this kind of analysis than are the typical male patterns.

Aside from promotion, there are broad issues relating to the effects of population aging on geographic, industrial, and occupational mobility, as well as on mobility between employers. Labour force mobility is a significant consideration if the economy is to adjust without undue difficulty to the changes that are in store.

We have illustrated some of the marked differences in age distributions that are apparent among occupations and industries. It would be useful to undertake a thorough review of the age-sex composition of a wide variety of industrial and occupational groupings, working at a disaggregated level, with a view to identifying those in which the age distributions are suggestive of future difficulties. Aside from obvious concerns about pension funding, there are also more subtle concerns about problems with personnel relations in industries with disproportionate numbers of older workers: How is it possible to avoid discouraging younger workers in the industry or occupation when their promotion prospects are poor? How is it possible to ensure an appropriate supply of "new blood" in such industries? What is the appropriate role of the government in such matters? There are industries and occupations in which federal or provincial governments play a major role in financing or in determining the numbers of people who receive training; examples include postsecondary programs (such as teacher training programs and medicine) and programs at least partly outside the formal educational system (such as manpower training). In such cases, how does the changing composition of the labour force affect the manpower planning criteria that should be brought to bear?

Footnotes

1. This section and the following one draw, in part, on earlier work reported in Denton, Feaver, and Spencer (1985), but have been revised (as explained below) to take into account information that has become available recently.

2. The projections are similar to earlier ones reported elsewhere by the authors and Christine Feaver. (See Denton, Feaver, and Spencer 1985.) However, the projections presented here take account of more recent information, are more detailed, and extend over a somewhat longer period. They start from an estimate of the total population as of June 1, 1986 (the level is 25.591 million). In the absence of 1986 census estimates, the detailed age-sex composition of the 1986 population is estimated by the authors, based on projections starting from the 1981 census estimates, making allowance for age-sex-specific trends in mortality rates and taking into account those official annual estimates of immigration, emigration, and the total fertility rate that are available.

   It may be useful to elaborate somewhat on the assumptions which underlie the projections. All age-specific fertility rates are fixed in proportionate terms at levels based on 1981 experience; in projections in which the total fertility rate is altered the age-specific rates are assumed to move up or down in proportion. Changes in mortality rates are based on the average annual percentage declines in age-sex-specific rates between 1961 and 1981, as indicated by the Statistics Canada life tables for those years. In the standard projection the annual percentage declines are assumed to diminish gradually; they are phased out linearly between 1981 and 2031 so that mortality reductions have ceased altogether by the latter year. (The year by which the rates are assumed to stop changing is what distinguishes the mortality assumptions in the standard and alternative projections.) Fixed levels of immigration and emigration are assumed throughout the projection period. The age-sex percentage distributions of immigrants and emigrants are fixed and are based on data averaged over the three years June 1, 1981 to May 31, 1984.

3. The labour force projections incorporate Statistics Canada (Labour Force Survey) 1985 estimates of participation rates for each age-sex group; the 1986 rates are preliminary estimates by the authors.

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FIGURE 1: Distribution of Total Labour Force, Canada, 1981

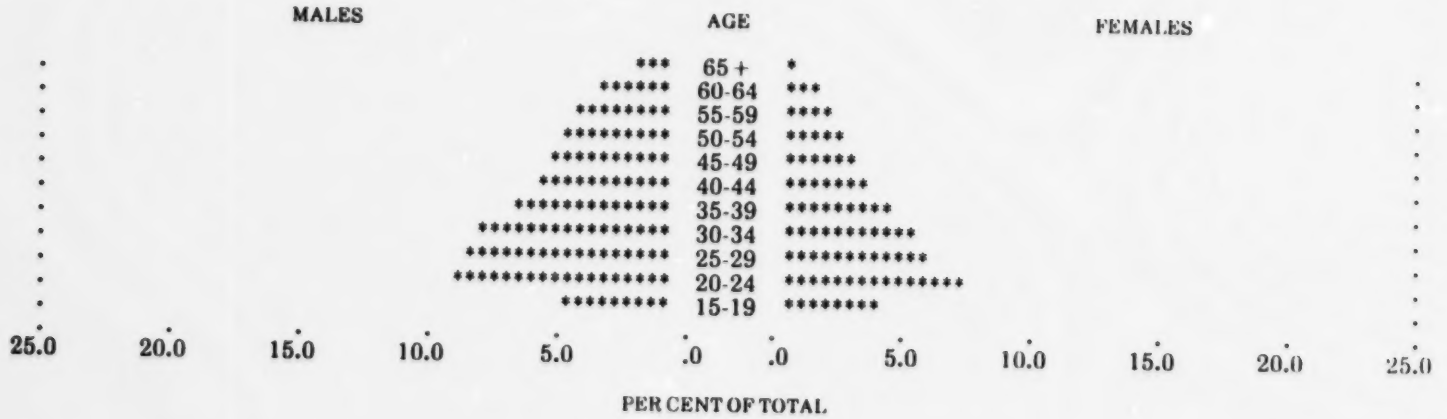


FIGURE 2: Distribution of Elementary and Kindergarten Teachers, Canada, 1981

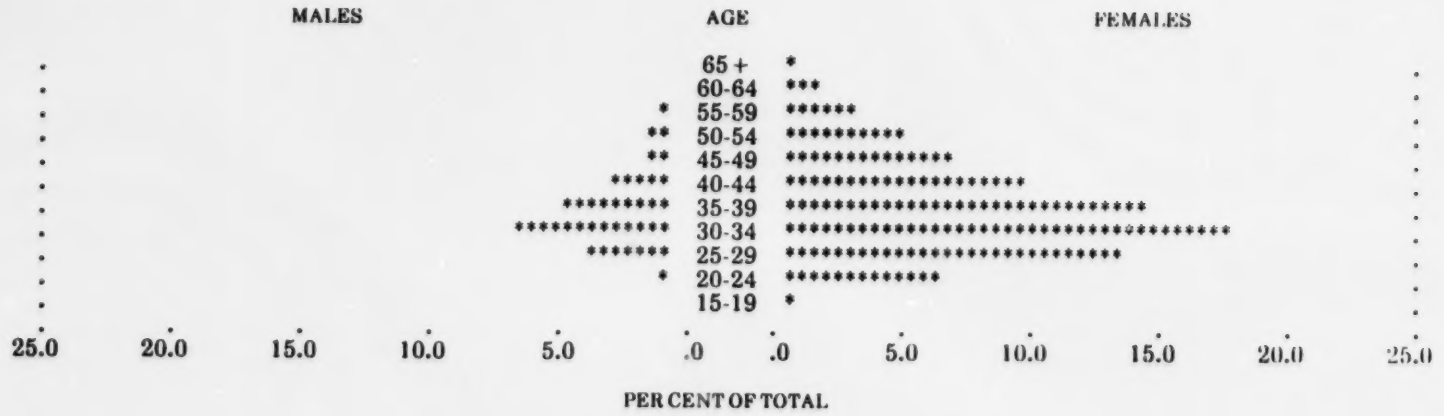
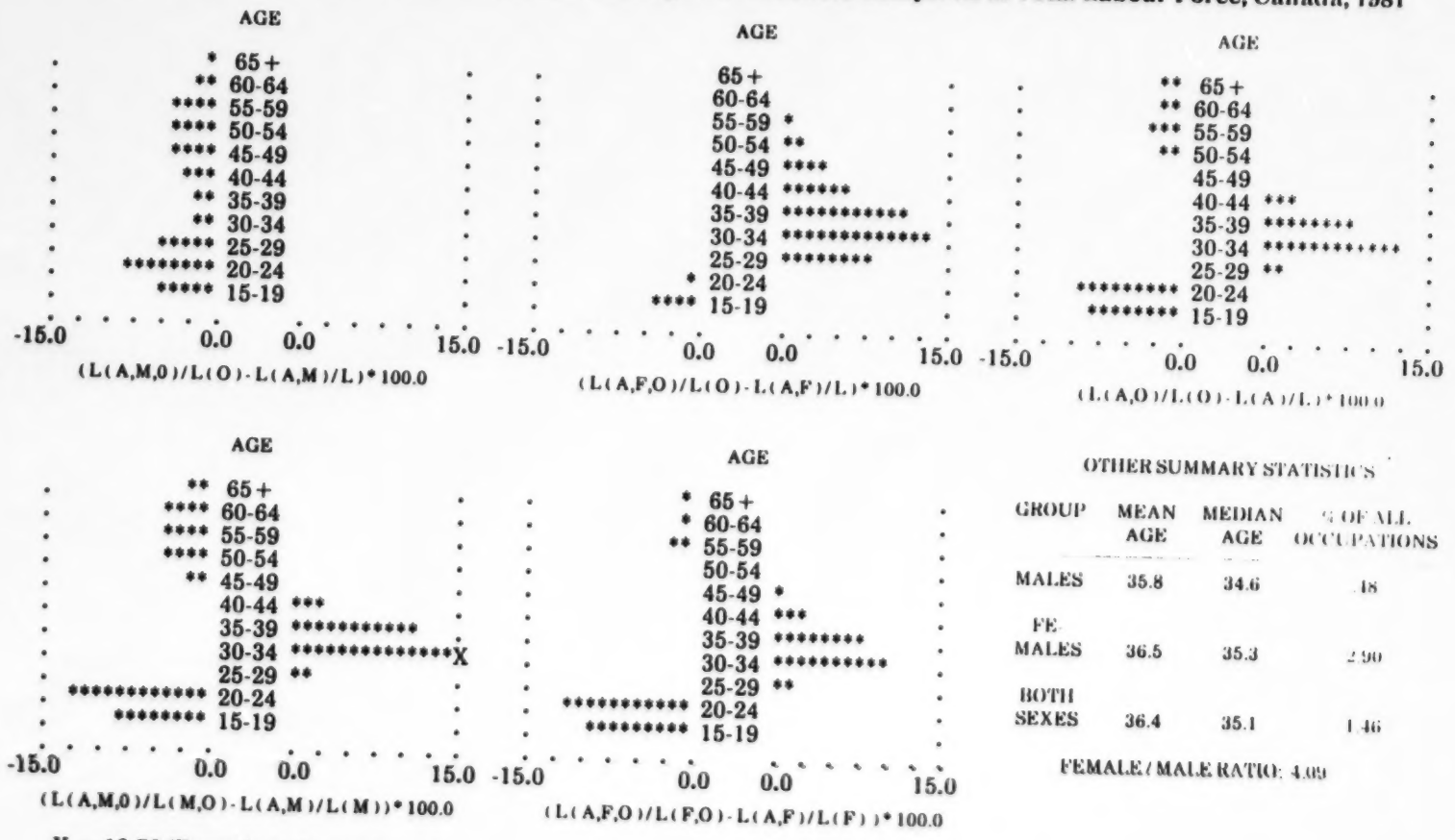


FIGURE 3: Distribution of Elementary and Kindergarten Teachers Compared to Total Labour Force, Canada, 1981



OTHER SUMMARY STATISTICS

GROUP	MEAN AGE	MEDIAN AGE	% OF ALL OCCUPATIONS
MALES	35.8	34.6	.48
FEMALES	36.5	35.3	2.90
BOTH SEXES	36.4	35.1	1.46

FEMALE/MALE RATIO: 4.09

X = 18.72 (Exceeds scale maximum)

Legend: L stands for Labour Force; A for Age; M for Males; F for Females; O for Occupation.
Thus L(A,M,O) is the Male Labour Force of Age A in Occupation O, L(M,O) is the Total Male Labour Force in Occupation O, L(M) is the Total Male Labour Force for all occupations combined, etc.

FIGURE 4: Distribution of Physicians and Surgeons, Canada, 1981

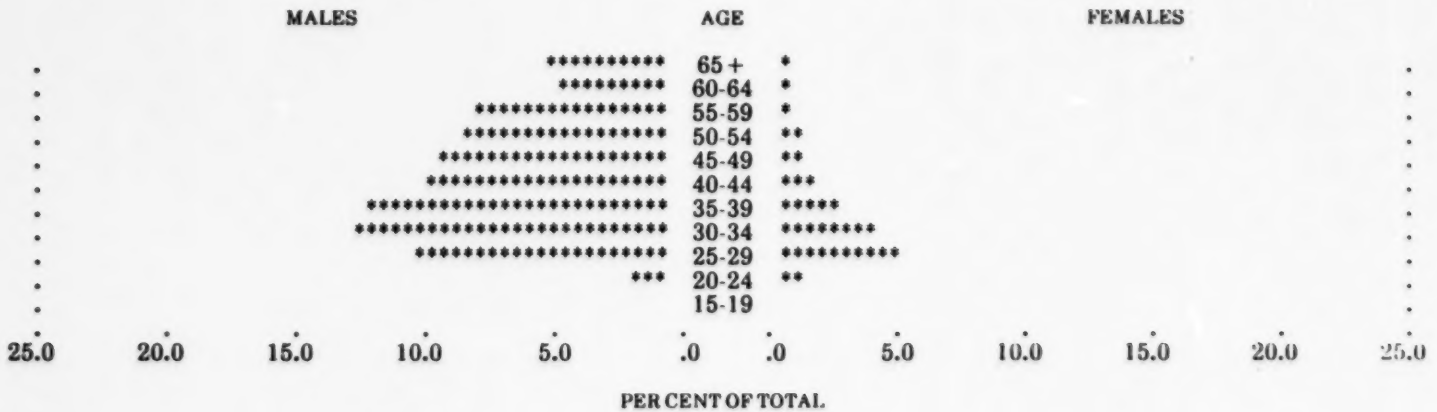
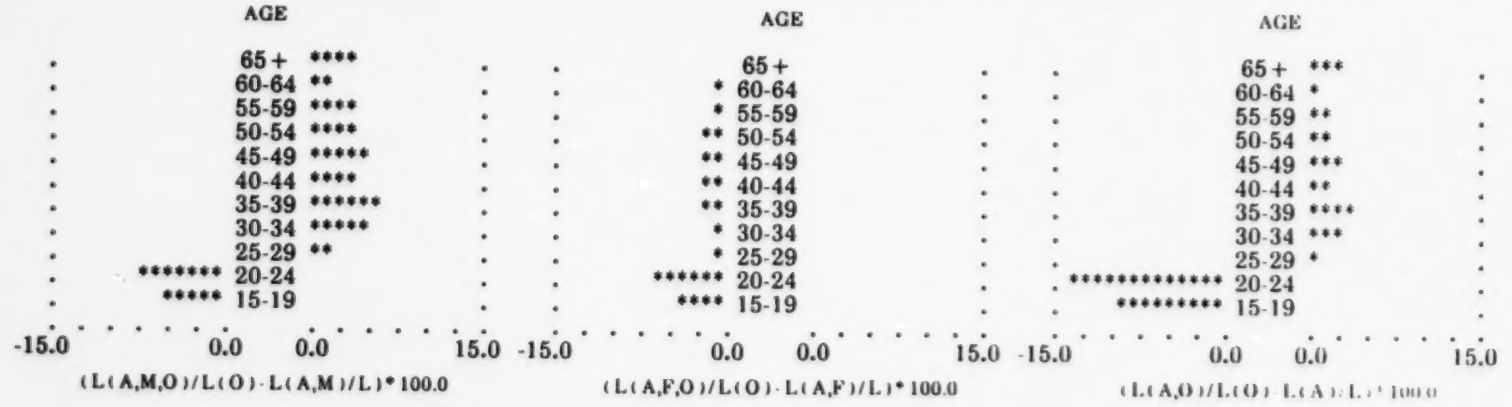
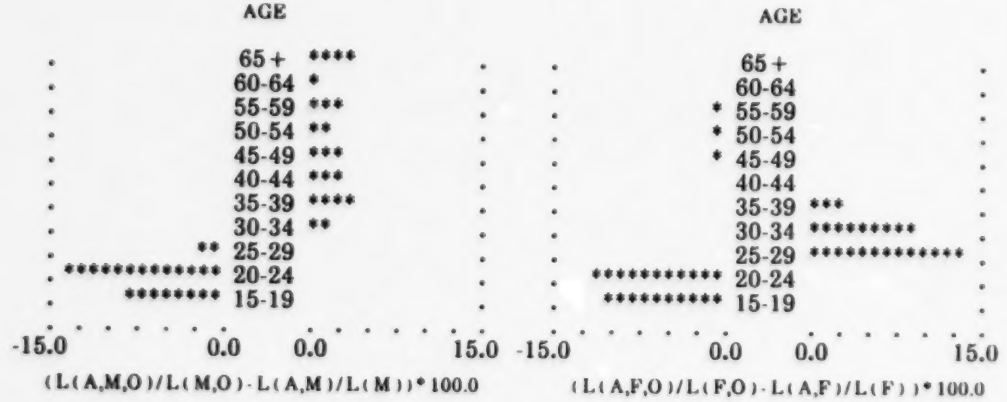


FIGURE 5: Distribution of Physicians and Surgeons Compared to Total Labour Force, Canada, 1981





OTHER SUMMARY STATISTICS

GROUP	MEAN AGE	MEDIAN AGE	% OF ALL OCCUPATIONS
MALES	43.2	42.0	.48
FEMALES	35.9	33.3	.15
BOTH SEXES	41.9	40.1	.34

FEMALE/MALE RATIO: .21

Legend: L stands for Labour Force; A for Age; M for Males; F for Females; O for Occupation.
Thus L(A,M,O) is the Male Labour Force of Age A in Occupation O, L(M,O) is the Total Male Labour Force in Occupation O, L(M) is the Total Male Labour Force for all occupations combined, etc.

FIGURE 6: Distribution of Labour Force in Agriculture Industry, Canada, 1981

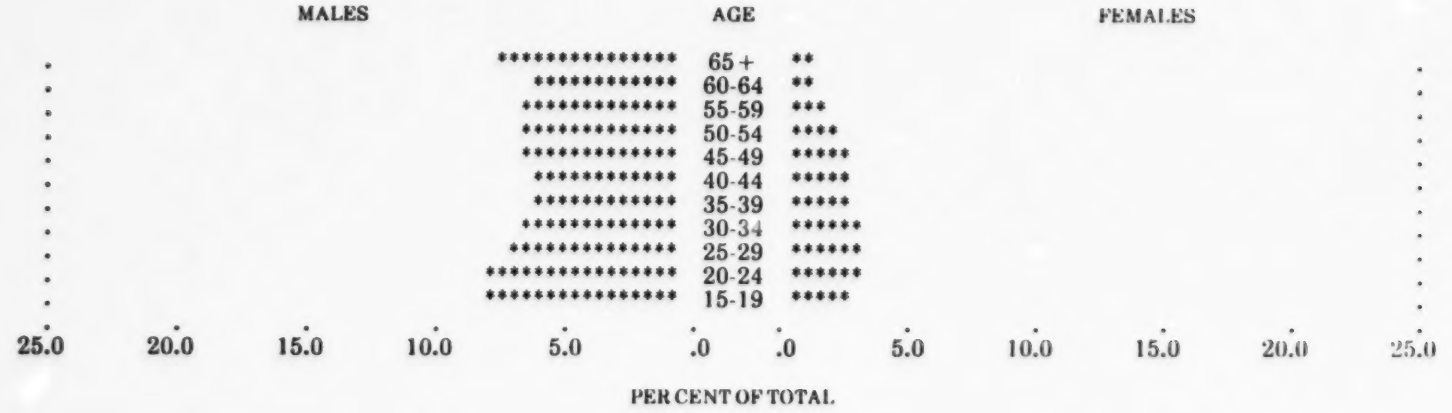
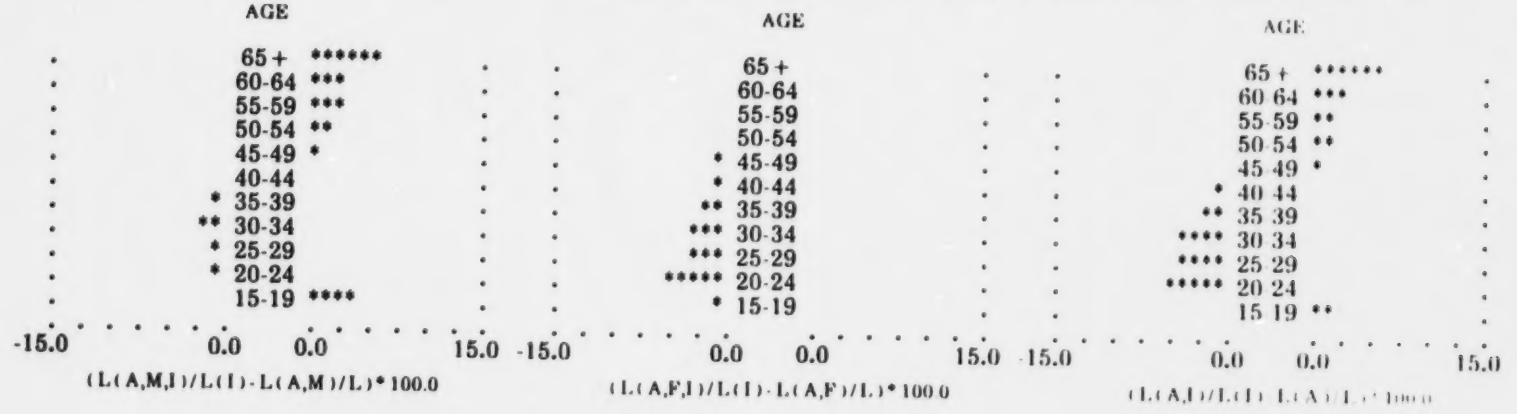
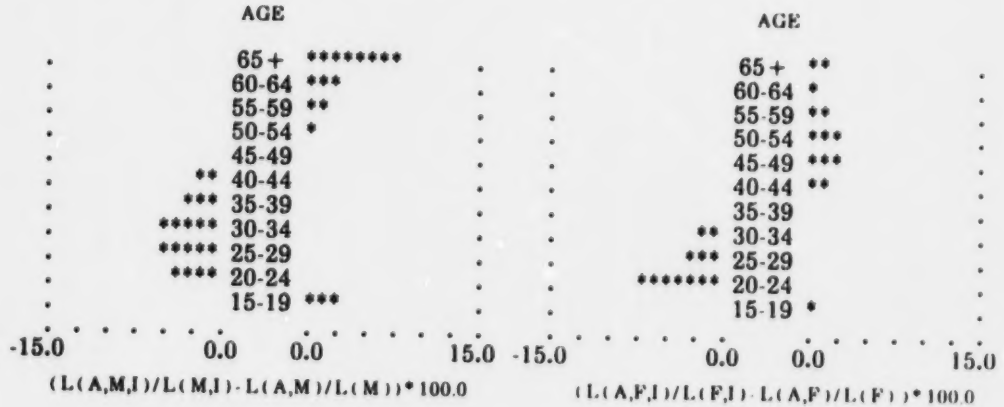


FIGURE 7: Distribution of Labour Force in Agriculture Industry Compared to Total Labour Force, Canada, 1981





OTHER SUMMARY STATISTICS

GROUP	MEAN AGE	MEDIAN AGE	% OF ALL INDUSTRIES
MALES	41	41.3	3.18
FEMALES	34	37.5	2.51
BOTH SEXES	40	40.1	3.10

FEMALE/MALE RATIO .83

Legend: L stands for Labour Force; A for Age; M for Males; F for Females; I for Industry.
Thus L(A,M,I) is the Male Labour Force of Age A in Industry I, L(M,I) is the Total Male Labour Force in Industry I, L(M) is the Total Male Labour Force for all industries combined, etc.

FIGURE 8: Distribution of Labour Force in Manufacturing Industries, Canada, 1981

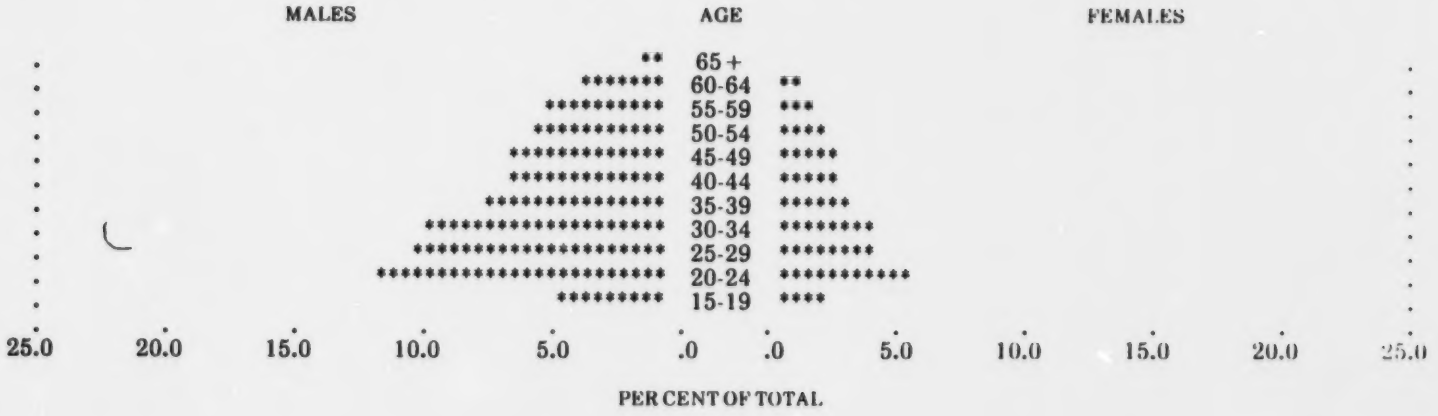
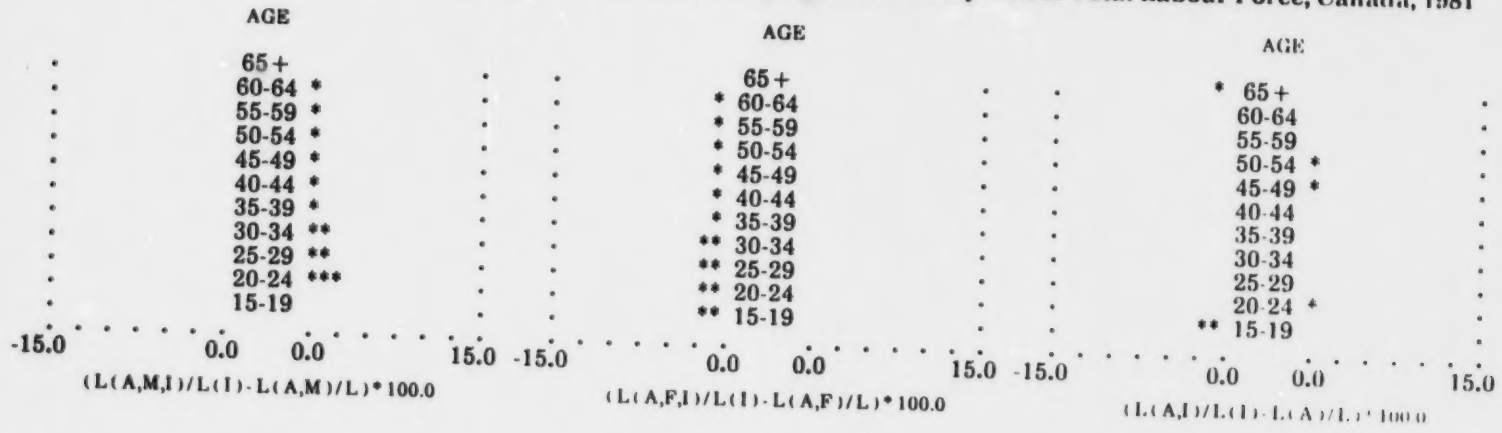
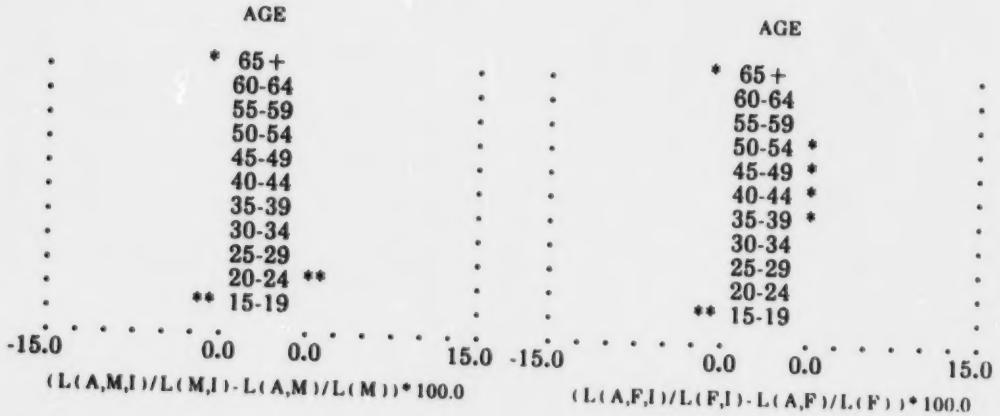


FIGURE 9: Distribution of Labour Force in Manufacturing Industries Compared to Total Labour Force, Canada, 1981





OTHER SUMMARY STATISTICS

GROUP	MEAN AGE	MEDIAN AGE	% OF ALL INDUSTRIES
MALES	37	34.3	23.19
FEMALES	35	33.4	13.29
BOTH SEXES	36	34.4	19.19

FEMALE / MALE RATIO: .39

Legend: L stands for Labour Force; A for Age; M for Males; F for Females; I for Industry.
Thus L(A,M,I) is the Male Labour Force of Age A in Industry I, L(M,I) is the Total Male Labour Force in Industry I, L(M) is the Total Male Labour Force for all industries combined, etc.

TABLE 1: THE POPULATION AND LABOUR FORCE OF CANADA, CENSUS YEARS, 1951 - 1981

	1951	1956	1961	1966	1971	1976	1981
CANADA							
Population							
Total ('000)	14009	16081	18238	20015	21568	22993	24342
0 - 19 (%)	37.9	39.7	41.8	42.1	39.4	35.8	32.0
20 - 64 (%)	54.4	52.5	50.6	50.2	52.5	55.5	58.3
65+ (%)	7.8	7.7	7.6	7.7	8.1	8.7	9.7
Population Ratios							
0-19 / 20-64	0.70	0.76	0.83	0.84	0.75	0.65	0.55
65+ / 20-64	0.14	0.15	0.15	0.15	0.15	0.16	0.17
Females/Males, 65+	0.97	1.00	1.06	1.15	1.23	1.29	1.34
Labour Force ('000)	5274	5826	6556	7503	8649	10203	11904
15 - 24 (%)	24.6	22.7	21.9	24.1	25.8	26.9	25.8
25 - 44 (%)	44.9	46.2	45.4	43.0	42.6	44.7	47.6
45 - 64 (%)	25.9	26.9	28.9	29.5	29.2	26.7	24.9
65+ (%)	4.6	4.3	3.8	3.3	2.5	1.7	1.6
Labour Force Ratios							
Pop. 0-19 / LF	1.01	1.10	1.16	1.12	0.98	0.81	0.66
Pop. 65+ / LF	0.21	0.21	0.21	0.21	0.20	0.20	0.20
Total Pop. / LF	2.68	2.78	2.80	2.69	2.49	2.23	2.03
Females/Males	0.30	0.32	0.39	0.45	0.52	0.60	0.69
– Regions, as Per cent of Canada Total –							
POPULATION							
Atlantic	11.5	11.0	10.4	9.9	9.5	9.5	9.2
Quebec	29.0	28.8	28.8	28.9	27.9	27.1	26.4
Ontario	32.8	33.6	34.2	34.8	35.7	35.9	35.4
Prairies	18.2	17.7	17.4	16.9	16.4	16.4	17.4
B.C.	8.3	8.7	8.9	9.4	10.1	10.7	11.3
LABOUR FORCE							
Atlantic	9.6	8.7	8.5	8.2	7.8	7.9	7.6
Quebec	27.7	27.6	27.6	28.2	27.2	26.4	25.5
Ontario	36.3	37.7	37.4	37.2	38.1	38.0	37.5
Prairies	18.2	17.3	17.7	16.8	16.6	16.8	17.9
B.C.	8.2	8.7	8.8	9.6	10.4	10.9	11.4

Note: The population figures relate to June 1 of each census year, while the labour force figures are annual averages. The labour force figures from 1951 to 1981 are based on estimates from the Statistics Canada Labour Force Survey. All labour force estimates prior to 1976 have been adjusted by the authors to make them consistent with new definitions introduced into the Labour Force Survey in the latter year. Components may not add precisely to totals because of rounding.

TABLE 2: PROJECTED POPULATION OF CANADA, 1986 - 2036, UNDER STANDARD ASSUMPTIONS

Age Groups	1986	1991	1996	2001	2006	2011	2016	2021	2026	2031	2036
					– '000s –						
0 - 19	7392	7389	7401	7273	6997	6717	6568	6506	6420	6262	6074
20 - 64	15479	16240	16827	17414	18011	18354	18208	17795	17168	16573	16322
65 - 69	908	1051	1086	1089	1156	1398	1742	1878	2047	2050	1744
70 - 74	744	806	936	970	975	1040	1258	1568	1693	1844	1846
75 - 79	519	615	673	785	817	825	884	1072	1335	1444	1573
80+	549	682	843	993	1175	1315	1404	1500	1704	2045	2351
Total	25591	26783	27766	28524	29131	29648	30063	30318	30367	30219	29909
Median Age	31.5	33.4	35.5	37.7	39.6	40.9	41.9	42.7	43.5	44.4	45.2
					– Per cent of Total –						
0 - 19	28.9	27.6	26.6	25.5	24.0	22.7	21.8	21.4	21.1	20.7	20.3
20 - 64	60.5	60.6	60.6	61.1	61.8	61.9	60.6	58.7	56.5	54.8	54.6
65 - 69	3.5	3.9	3.9	3.8	4.0	4.7	5.8	6.2	6.7	6.8	5.8
70 - 74	2.9	3.0	3.4	3.4	3.3	3.5	4.2	5.2	5.6	6.1	6.2
75 - 79	2.0	2.3	2.4	2.8	2.8	2.8	2.9	3.5	4.4	4.8	5.3
80+	2.1	2.5	3.0	3.5	4.0	4.4	4.7	4.9	5.6	6.8	7.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Females/Males					– Ratio –						
0 - 19	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
20 - 64	1.01	1.00	1.00	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00
65 - 69	1.19	1.20	1.15	1.14	1.16	1.16	1.17	1.19	1.18	1.14	1.14
70 - 74	1.28	1.31	1.32	1.27	1.26	1.28	1.27	1.29	1.31	1.30	1.26
75 - 79	1.44	1.48	1.52	1.53	1.47	1.47	1.48	1.48	1.50	1.52	1.51
80+	1.92	2.00	2.09	2.20	2.27	2.28	2.31	2.33	2.30	2.29	2.33
Total	1.02	1.03	1.04	1.04	1.05	1.06	1.06	1.07	1.08	1.09	1.10

Note: Components may not add precisely to totals because of rounding.

TABLE 3: PROJECTED LABOUR FORCE OF CANADA, 1986 - 2036, UNDER STANDARD ASSUMPTIONS

Age Groups	1986	1991	1996	2001	2006	2011	2016	2021	2026	2031	2036
					– '000s –						
15 - 24	2822	2492	2417	2506	2604	2562	2396	2263	2231	2252	2242
25 - 44	6746	7600	7770	7635	7207	6864	6865	6877	6766	6527	6286
45 - 64	3146	3479	4109	4758	5349	5759	5625	5322	5067	4939	4984
65+	184	196	196	192	204	233	276	309	344	365	350
Total	12898	13767	14494	15090	15364	15418	15163	14770	14408	14083	13862
Median Age	34.7	35.9	37.4	38.8	39.9	40.1	39.9	39.7	39.8	40.0	40.2
					– Per cent of Total –						
15 - 24	21.9	18.1	16.7	16.6	16.9	16.6	15.8	15.3	15.5	16.0	16.2
25 - 44	52.3	55.2	53.6	50.5	47.0	44.5	45.3	46.5	47.0	46.3	45.4
45 - 64	24.3	25.2	28.4	31.6	34.8	37.4	37.1	36.0	35.2	35.0	36.0
65+	1.4	1.4	1.4	1.3	1.3	1.5	1.8	2.1	2.4	2.6	2.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
					– Ratio –						
Females/Males											
15 - 24	0.89	0.90	0.91	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
25 - 44	0.76	0.81	0.84	0.87	0.86	0.86	0.86	0.86	0.86	0.86	0.86
45 - 64	0.62	0.66	0.71	0.75	0.75	0.73	0.72	0.70	0.70	0.71	0.71
65+	0.42	0.42	0.41	0.40	0.41	0.40	0.41	0.41	0.41	0.41	0.42
Total	0.74	0.78	0.81	0.83	0.82	0.81	0.80	0.80	0.80	0.80	0.80
Population/LF	1.98	1.95	1.92	1.89	1.90	1.92	1.98	2.05	2.11	2.15	2.16

Note: Components may not add precisely to totals because of rounding.

TABLE 4: PROJECTED POPULATION OF CANADA UNDER ALTERNATIVE ASSUMPTIONS

Year	Total Population		Percentage Distribution by Age			
	'000s	index	0-19	20-64	65-74	75+
1986	25591	100.0	28.9	60.5	6.5	4.2
		– Standard Assumptions –				
1991	26783	104.7	27.6	60.6	6.9	4.8
1996	27765	108.5	26.6	60.6	7.3	5.5
2001	28524	111.5	25.5	61.1	7.2	6.2
2006	29131	113.8	24.0	61.8	7.3	6.8
2011	29648	115.9	22.7	61.9	8.2	7.2
2016	30063	117.5	21.8	60.6	10.0	7.6
2021	30318	118.5	21.4	58.7	11.4	8.5
2026	30367	118.7	21.1	56.5	12.3	10.0
2031	30219	118.1	20.7	54.8	12.9	11.5
2036	29909	116.9	20.3	54.6	12.0	13.1
		– High Fertility –				
1991	27143	106.1	28.5	59.8	6.8	4.8
1996	29136	113.9	30.1	57.8	6.9	5.2
2001	31150	121.7	31.7	55.9	6.6	5.7
2006	32980	128.9	32.9	54.6	6.5	6.0
2011	34829	136.1	33.1	53.7	7.0	6.1
2016	36939	144.3	32.7	53.0	8.1	6.2
2021	39432	154.1	33.1	51.7	8.7	6.5
2026	42131	164.6	34.2	49.8	8.9	7.2
2031	44822	175.1	35.2	48.4	8.7	7.8
2036	47533	185.7	35.6	48.6	7.6	8.3
		– Low Fertility –				
1991	26700	104.3	27.3	60.8	7.0	4.9
1996	27449	107.3	25.8	61.3	7.4	5.5
2001	27918	109.1	23.9	62.4	7.4	6.4
2006	28244	110.4	21.6	63.8	7.5	7.1
2011	28466	111.2	19.8	64.2	8.6	7.5
2016	28548	111.6	18.8	62.7	10.5	8.0
2021	28415	111.0	18.3	60.5	12.1	9.1
2026	28039	109.6	17.7	58.1	13.3	10.8
2031	27454	107.3	17.0	56.1	14.2	12.7
2036	26700	104.3	16.3	55.5	13.4	14.7
		– High Mortality –				
1991	26778	104.6	27.6	60.6	6.9	4.8
1996	27750	108.4	26.6	60.6	7.3	5.4
2001	28486	111.3	25.5	61.1	7.2	6.2
2006	29058	113.5	24.0	61.9	7.3	6.7
2011	29523	115.4	22.7	62.1	8.2	7.0

TABLE 4 (Continued)

Year	Total Population		Percentage Distribution by Age			
	'000s	index	0-19	20-64	65-74	75+
2016	29869	116.7	22.0	60.8	9.9	7.3
2021	30042	117.4	21.6	59.1	11.3	8.0
2026	30007	117.3	21.3	57.0	12.2	9.4
2031	29776	116.4	21.0	55.4	12.8	10.8
2036	29394	114.9	20.6	55.3	11.9	12.2
			– Low Mortality –			
1991	26786	104.7	27.6	60.6	6.9	4.8
1996	27778	108.5	26.6	60.6	7.3	5.5
2001	28552	111.6	25.5	61.0	7.2	6.3
2006	29186	114.0	24.0	61.7	7.3	6.9
2011	29741	116.2	22.6	61.8	8.2	7.4
2016	30208	118.0	21.8	60.4	10.0	7.9
2021	30532	119.3	21.3	58.4	11.4	8.8
2026	30668	119.8	21.0	56.1	12.4	10.5
2031	30632	119.7	20.5	54.3	13.0	12.3
2036	30462	119.0	20.0	53.8	12.1	14.1
			– High Immigration –			
1991	27045	105.7	27.6	60.7	6.9	4.8
1996	28312	110.6	26.7	60.6	7.2	5.4
2001	29370	114.8	25.6	61.1	7.2	6.1
2006	30287	118.4	24.2	61.8	7.2	6.7
2011	31120	121.6	23.0	61.9	8.1	7.1
2016	31859	124.5	22.2	60.7	9.7	7.4
2021	32445	126.8	21.9	59.0	11.0	8.2
2026	32830	128.3	21.5	57.0	11.9	9.6
2031	33019	129.0	21.2	55.5	12.4	11.0
2036	33042	129.1	20.8	55.2	11.7	12.4
			– Low Immigration –			
1991	26521	103.6	27.6	60.6	7.0	4.9
1996	27219	106.4	26.6	60.6	7.3	5.5
2001	27677	108.2	25.3	61.0	7.3	6.3
2006	27975	109.3	23.8	61.8	7.4	7.0
2011	28176	110.1	22.3	61.9	8.4	7.4
2016	28268	110.5	21.4	60.4	10.3	7.8
2021	28191	110.2	21.0	58.3	11.8	8.8
2026	27903	109.0	20.7	56.0	12.8	10.5
2031	27418	107.1	20.2	54.1	13.4	12.2
2036	26777	104.6	19.8	53.8	12.4	14.0

Note: Components may not add precisely to 100.0 because of rounding.

TABLE 5: PROJECTED LABOUR FORCE OF CANADA UNDER ALTERNATIVE ASSUMPTIONS

Year	Total Labour Force		Percentage Distribution by Age			
	'000s	index	15-24	25-44	45-64	65+
1986	12898	100.0	21.9	52.3	24.3	1.4
		– Standard Assumptions –				
1991	13767	106.7	18.1	55.2	25.2	1.4
1996	14494	112.4	16.7	53.6	28.4	1.4
2001	15090	117.0	16.6	50.5	31.6	1.3
2006	15364	119.1	16.9	47.0	34.8	1.3
2011	15418	119.5	16.6	44.5	37.4	1.5
2016	15163	117.6	15.8	45.3	37.1	1.8
2021	14770	114.5	15.3	46.5	36.0	2.1
2026	14408	111.7	15.5	47.0	35.2	2.4
2031	14083	109.2	16.0	46.3	35.0	2.6
2036	13862	107.5	16.2	45.4	36.0	2.5
		– High Fertility –				
1991	13767	106.7	18.1	55.2	25.2	1.4
1996	14494	112.4	16.7	53.6	28.4	1.4
2001	15090	117.0	16.6	50.5	31.6	1.3
2006	15526	120.4	17.8	46.4	34.5	1.3
2011	16212	125.7	20.7	42.3	35.6	1.4
2016	16949	131.4	22.8	42.4	33.2	1.6
2021	17617	136.6	22.2	45.8	30.2	1.8
2026	18371	142.4	21.3	49.2	27.6	1.9
2031	19377	150.2	21.7	50.9	25.5	1.9
2036	20868	161.8	22.9	50.2	25.3	1.7
		– Low Fertility –				
1991	13767	106.7	18.1	55.2	25.2	1.4
1996	14494	112.4	16.7	53.6	28.4	1.4
2001	15090	117.0	16.6	50.5	31.6	1.3
2006	15327	118.8	16.7	47.0	34.9	1.3
2011	15234	118.1	15.6	45.1	37.8	1.5
2016	14750	114.4	13.9	46.0	38.1	1.9
2021	14114	109.4	13.3	46.8	37.7	2.2
2026	13500	104.7	13.7	46.2	37.5	2.5
2031	12900	100.0	14.3	44.6	38.3	2.8
2036	12368	95.9	14.3	43.1	39.8	2.8
		– High Mortality –				
1991	13766	106.7	18.1	55.2	25.2	1.4
1996	14491	112.4	16.7	53.6	28.3	1.4
2001	15085	117.0	16.6	50.6	31.5	1.3
2006	15352	119.0	17.0	47.0	34.8	1.3
2011	15397	119.4	16.6	44.5	37.3	1.5

TABLE 5 (Continued)

Year	Total Labour Force		Percentage Distribution by Age			
	'000s	index	15-24	25-44	45-64	65+
2016	15132	117.3	15.8	45.3	37.1	1.8
2021	14729	114.2	15.4	46.7	36.0	2.0
2026	14357	111.3	15.5	47.1	35.1	2.3
2031	14025	108.7	16.0	46.5	35.0	2.5
2036	13796	107.0	16.2	45.4	35.9	2.4
		– Low Mortality –				
1991	13767	106.7	18.1	55.2	25.2	1.4
1996	14495	112.4	16.7	53.6	28.4	1.4
2001	15095	117.0	16.6	50.5	31.6	1.3
2006	15373	119.2	16.9	46.8	34.8	1.3
2011	15433	119.7	16.6	44.5	37.4	1.5
2016	15185	117.7	15.8	45.3	37.1	1.8
2021	14802	114.8	15.3	46.5	36.1	2.1
2026	14450	112.0	15.5	46.9	35.2	2.4
2031	14135	109.6	16.0	46.3	35.1	2.7
2036	13927	108.0	16.1	45.2	36.1	2.6
		– High Immigration –				
1991	13909	107.8	18.2	55.2	25.2	1.4
1996	14790	114.7	16.8	53.8	28.1	1.3
2001	15551	120.6	16.7	51.0	31.0	1.3
2006	15992	124.0	17.0	47.5	34.2	1.3
2011	16224	125.8	16.7	45.1	36.6	1.5
2016	16150	125.2	16.0	45.8	36.5	1.8
2021	15934	123.5	15.5	47.0	35.6	2.0
2026	15736	122.0	15.6	47.4	34.7	2.3
2031	15567	120.7	16.1	46.8	34.6	2.5
2036	15496	120.1	16.3	46.0	35.3	2.4
		– Low Immigration –				
1991	13625	105.6	18.0	55.2	25.4	1.4
1996	14197	110.1	16.6	53.4	28.6	1.4
2001	14630	113.4	16.5	50.2	32.0	1.3
2006	14736	114.3	16.9	46.3	35.4	1.4
2011	14612	113.3	16.5	43.8	38.1	1.6
2016	14175	109.9	15.6	44.7	37.8	1.9
2021	13607	105.5	15.1	46.1	36.7	2.2
2026	13080	101.4	15.3	46.5	35.7	2.5
2031	12600	97.7	15.9	45.7	35.6	2.8
2036	12228	94.8	16.1	44.6	36.7	2.7

Note: Components may not add precisely to 100.0 because of rounding.

TABLE 6: PROJECTED DEPENDENCY RATIOS, 1986 - 2036, UNDER ALTERNATIVE ASSUMPTIONS REGARDING POPULATION GROWTH

	Population Ratios		Labour Force Ratios		
	Pop 0-19	Pop 65+	Pop 0-19	Pop 65+	Pop
Year	Pop 20-64	Pop 20-64	LF	LF	LF
1986	0.48	0.18	0.57	0.21	1.98
		– Standard Assumptions –			
1991	0.46	0.19	0.54	0.23	1.95
1996	0.44	0.21	0.51	0.25	1.92
2001	0.42	0.22	0.48	0.25	1.89
2006	0.39	0.23	0.46	0.27	1.90
2011	0.37	0.25	0.44	0.30	1.92
2016	0.36	0.29	0.43	0.35	1.98
2021	0.36	0.34	0.44	0.41	2.05
2026	0.37	0.39	0.44	0.47	2.11
2031	0.38	0.45	0.44	0.52	2.15
2036	0.37	0.46	0.44	0.54	2.16
		– High Fertility –			
1991	0.48	0.19	0.56	0.23	1.97
1996	0.54	0.21	0.63	0.24	2.01
2001	0.57	0.22	0.65	0.25	2.06
2006	0.60	0.23	0.70	0.27	2.12
2011	0.62	0.24	0.71	0.28	2.15
2016	0.62	0.27	0.71	0.31	2.18
2021	0.64	0.29	0.74	0.34	2.24
2026	0.69	0.32	0.78	0.37	2.29
2031	0.73	0.34	0.81	0.38	2.31
2036	0.73	0.33	0.81	0.36	2.28
		– Low Fertility –			
1991	0.45	0.20	0.53	0.23	1.94
1996	0.42	0.21	0.49	0.24	1.89
2001	0.38	0.22	0.44	0.26	1.85
2006	0.34	0.23	0.40	0.27	1.84
2011	0.31	0.25	0.37	0.30	1.87
2016	0.30	0.30	0.36	0.36	1.94
2021	0.30	0.35	0.37	0.43	2.01
2026	0.30	0.41	0.37	0.50	2.08
2031	0.30	0.48	0.36	0.57	2.13
2036	0.29	0.51	0.35	0.61	2.16
		– High Mortality –			
1991	0.46	0.19	0.54	0.23	1.95
1996	0.44	0.21	0.51	0.24	1.91
2001	0.42	0.22	0.48	0.25	1.89
2006	0.39	0.23	0.45	0.27	1.89
2011	0.37	0.24	0.44	0.29	1.92

TABLE 6 (Continued)

Year	Population Ratios		Labour Force Ratios		
	Pop 0-19 / Pop 20-64	Pop 65+ / Pop 20-64	Pop 0-19 / LF	Pop 65+ / LF	Pop / LF
2016	0.36	0.28	0.43	0.34	1.97
2021	0.37	0.33	0.44	0.39	2.04
2026	0.37	0.38	0.45	0.45	2.09
2031	0.38	0.43	0.45	0.50	2.12
2036	0.37	0.44	0.44	0.51	2.13
		– Low Mortality –			
1991	0.46	0.19	0.54	0.23	1.95
1996	0.44	0.21	0.51	0.25	1.92
2001	0.42	0.22	0.48	0.26	1.89
2006	0.39	0.23	0.46	0.27	1.90
2011	0.37	0.25	0.44	0.30	1.93
2016	0.36	0.30	0.43	0.36	1.99
2021	0.36	0.35	0.44	0.42	2.06
2026	0.37	0.41	0.45	0.49	2.12
2031	0.38	0.47	0.44	0.55	2.17
2036	0.37	0.49	0.44	0.57	2.19
		– High Immigration –			
1991	0.45	0.19	0.54	0.23	1.94
1996	0.44	0.21	0.51	0.24	1.91
2001	0.42	0.22	0.48	0.25	1.89
2006	0.39	0.22	0.46	0.26	1.89
2011	0.37	0.25	0.44	0.29	1.92
2016	0.37	0.28	0.44	0.34	1.97
2021	0.37	0.33	0.45	0.39	2.04
2026	0.38	0.38	0.45	0.45	2.09
2031	0.38	0.42	0.45	0.50	2.12
2036	0.38	0.44	0.44	0.51	2.13
		– Low Immigration –			
1991	0.46	0.20	0.54	0.23	1.95
1996	0.44	0.21	0.51	0.25	1.92
2001	0.41	0.22	0.48	0.26	1.89
2006	0.39	0.23	0.45	0.27	1.90
2011	0.36	0.26	0.43	0.30	1.93
2016	0.35	0.30	0.43	0.36	1.99
2021	0.36	0.35	0.44	0.43	2.07
2026	0.37	0.42	0.44	0.50	2.13
2031	0.37	0.47	0.44	0.56	2.18
2036	0.37	0.49	0.43	0.58	2.19

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